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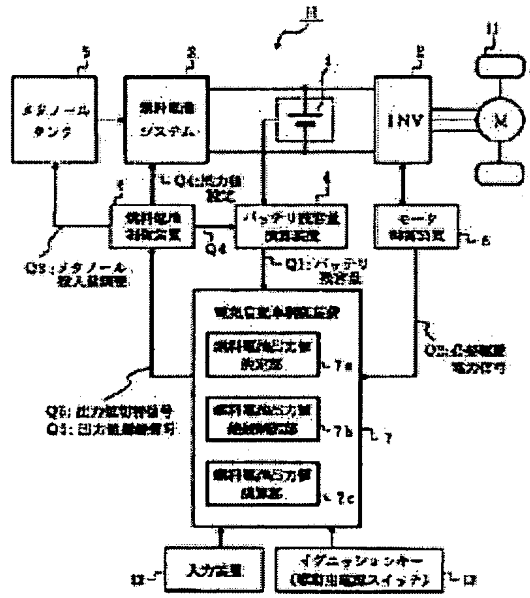
(54) HYBRID ELECTRIC POWER SOURCE DEVICE

(57)Abstract:
PURPOSE: To provide a hybrid electric power source device in which a secondary battery can be charged by operating a fuel cell even if a motor is in a driving inhibited state.
CONSTITUTION: A fuel cell output value computing unit 7c computes the output values of a fuel cell system 3 necessary to fully charge a battery 1, based on the charging time inputted from an input apparatus 12 and the battery's remaining capacity data from a battery's remaining capacity computing apparatus 4. Since the battery 1 is charged based on the output values, the battery 1 is in the full charged state after the inputted charging time.



CLAIMS

[Claim(s)]
[Claim 1]A rechargeable battery which supplies electric power for motor drives, and a fuel cell which outputs electric power for charging this rechargeable battery, A permission means to which a drive of said motor is permitted, and a detection means to detect whether this permission means is in an authorized state, A hybrid power supply device having a fuel cell output control means which continues charge of said rechargeable battery by said fuel cell when this detection means detects un-granting a permission of a motor drive.
[Claim 2]The hybrid power supply device according to claim 1, wherein said permission means is provided with said motor, an opening and closing means which opens and closes connection between rechargeable batteries, and an electric power switch for a drive which operates this opening and closing means.
[Claim 3]The hybrid power supply device according to claim 1 when it has a rechargeable battery remaining capacity detection means to detect charge remaining capacity of said rechargeable battery, and said rechargeable battery charge remaining capacity is below a predetermined value, wherein said fuel cell control means performs an output for charge from said fuel cell.
[Claim 4]The hybrid power supply device according to claim 1 when it has a rechargeable battery remaining capacity detection means to detect charge remaining capacity of said rechargeable battery, and rechargeable battery charge remaining capacity is below a predetermined value, wherein said fuel cell output control means performs an output for charge from a fuel cell with a value corresponding to said rechargeable battery remaining capacity.
[Claim 5]A charging time input means which carries out the setting input of the time to charge a rechargeable battery with the output of said fuel cell, Have rechargeable battery remaining capacity detection which detects charge remaining capacity of said rechargeable battery, and said fuel cell control means, Remaining capacity of a rechargeable battery detected by said rechargeable battery remaining capacity detection means when un-granting a permission of a drive was detected by said detection means, The hybrid power supply device according to claim 1, wherein said rechargeable battery calculates an output value which can be charged to a predetermined remaining capacity value and controls an output of said fuel cell based on charging time inputted from said charging time input means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the hybrid power supply device which is applied to a hybrid power supply device, for example, is used for the motor drives of an electromobile.
[0002]
[Description of the Prior Art]In recent years, the gasoline engine used as the source of release of harmful gas, etc. are not made into a driving source from a viewpoint of earth environment protection, but the electromobile which makes vehicles drive with clean electric power attracts attention. By the way, the rechargeable battery used for an electromobile has comparatively small energy capacity, although an output capacitance is large. Therefore, in the electromobile which uses a rechargeable battery as a power supply, there is a remarkable difference as compared with the distance it can run by one charge being around 100 km, and the mileage after [1 time of] full of the present gasoline-powered vehicle it runs by a gasoline engine being 400-500 km. Then, in order to extend the distance of an electromobile which can be run, although an output capacitance is small, the hybrid power supply device which combined the fuel cell with large energy capacity and the rechargeable battery is developed. Such a hybrid power supply device is used for the bus or the golf cart in a tentative way.
[0003]Conventionally, what was indicated by JP,H3-276573,A is known as an example which applied this hybrid power supply device to the electromobile. At the time of a run, the output of a fuel cell is usually used for the electromobile indicated by this gazette, and the battery is being used for it in order to back up the output shortage of a fuel cell at the time of load rapid increase of accelerating an electromobile suddenly. And at the time of a light load, the surplus electric power of a fuel cell is used for charge of a battery.
[0004]
[Problem(s) to be Solved by the Invention]However, in the hybrid power supply device indicated by said gazette, when battery residual quantity became less than 50%, since output voltage was insufficient, there was a possibility that a motor might not drive at the time of restart. When you are going to make it drive a motor only with the output of a fuel cell, the output of a fuel cell needs the output of not less than 10 kW. However, in order to obtain the output of not less than 10 kW, when the fuel cell became huge and the practical use side was taken into consideration, it was difficult [it] to attach to an electromobile. When it was going to charge the battery of the electromobile, the electromobile was driven to the stand etc. which have a battery charging equipment, for example, and kana **** did not become but was conventionally troublesome for the driver. Therefore, it is very convenient if it can make it possible to charge a battery during parking of an electromobile at arbitrary places. Then, the purpose of this invention is to provide the hybrid power supply device which can charge a battery using the time which a motor is stopping.
[0005]

[Means for Solving the Problem]A rechargeable battery which supplies electric power for motor drives in the invention according to claim 1, A fuel cell which outputs electric power for charging this rechargeable battery, and a permission means to which said motor drive is permitted, It has a detection means to detect whether this permission means is in an authorized state, and a fuel cell output control means which continues charge of said rechargeable battery by said fuel cell when this detection means detects un-granting a permission of a motor drive, and said purpose is attained. In the invention according to claim 2, said permission means is provided with said motor, an opening and closing means which opens and closes connection between rechargeable batteries, and an electric power switch for a drive which operates this opening and closing means, and attains said purpose.

[0006]In the invention according to claim 3, it has a rechargeable battery remaining capacity detection means to detect charge remaining capacity of said rechargeable battery, and when said rechargeable battery charge remaining capacity is below a predetermined value, said fuel cell control means is performing an output for charge from said fuel cell, and attains said purpose. In the invention according to claim 4, it has a rechargeable battery remaining capacity detection means to detect charge remaining capacity of said rechargeable battery, and said fuel cell output control means is performing an output for charge from a fuel cell with a value corresponding to said rechargeable battery remaining capacity, when rechargeable battery charge remaining capacity is below a predetermined value, and it attains said purpose.

[0007]A charging time input means which carries out the setting input of the time to charge a rechargeable battery with the output of said fuel cell in the invention according to claim 5, Have rechargeable battery remaining capacity detection which detects charge remaining capacity of said rechargeable battery, and said fuel cell control means, Remaining capacity of a rechargeable battery detected by said rechargeable battery remaining capacity detection means when un-granting a permission of a drive was detected by said detection means, Said purpose is attained because said rechargeable battery calculates an output value which can be charged to a predetermined remaining capacity value and controls an output of said fuel cell based on charging time inputted from said charging time input means.

[0008]

[Function]In the hybrid power supply device according to claim 1, a rechargeable battery drives a motor and a fuel cell charges a rechargeable battery. A permission means determines the propriety of a drive of a motor. A detection means detects the propriety of the motor drive of a permission means. And a fuel cell output control means is controlled to charge a rechargeable battery with the output of a fuel cell, when a detection means detects un-granting a permission of a motor drive. In the hybrid power supply device according to claim 2, a permission means is provided with said motor, the opening and closing means which opens and closes connection between rechargeable batteries, and the electric power switch for a drive which operates this opening and closing means, and the propriety of permission of a motor drive is determined by operation of the electric power switch for a drive. In the hybrid power supply device according to claim 3, a rechargeable battery remaining capacity detection means detects the charge remaining capacity of a rechargeable battery. A fuel cell output control means performs the output for charge from a fuel cell, when the rechargeable battery remaining capacity which the rechargeable battery remaining capacity detection means detected becomes below a predetermined value.

[0009]In the hybrid power supply device according to claim 4, a rechargeable battery remaining capacity detection means detects the charge remaining capacity of a rechargeable battery. A fuel cell output control means performs the output for charge from a fuel cell with the value corresponding to rechargeable battery remaining capacity, when the rechargeable battery remaining capacity which the rechargeable battery remaining capacity detection means detected becomes below a predetermined value. In the hybrid power supply device according to claim 5, time to charge a rechargeable battery is inputted from a charging time input means. A rechargeable battery

remaining capacity detection means detects rechargeable battery remaining capacity. And when a detection means detects un-granting a permission of a drive of a motor, a fuel cell output control means, Based on the rechargeable battery remaining capacity value which the rechargeable battery remaining capacity detection means detected, and the charging time inputted from the charging time input means, the output value of the fuel cell taken for a rechargeable battery to be charged by the predetermined remaining capacity value (for example, full charge) is calculated.

[0010]

[Example]Hereafter, working example in the hybrid power supply device of this invention is described in detail with reference to drawing 1 thru/or drawing 4. Drawing 1 is a system configuration figure at the time of applying the hybrid power supply device H of working example of this invention to an electromobile. This hybrid power supply device H is provided with the battery 1 as a "rechargeable battery" for supplying the electric power for driving the motor M of an electromobile. As this battery 1, various rechargeable batteries, such as a lead acid battery, a nickel-cadmium battery, a sodium sulfur battery, a lithium secondary battery, a hydrogen secondary battery, and a redox type cell, are used, for example. This battery 1 is 240, for example by connecting two or more sets of rechargeable batteries to series parallel in series. [V] It is constituted so that it may become voltage. With the battery 1 of this example, it is 12. [V] The battery cell is connected to 20-piece series.

[0011]It is connected to the inverter 2 which changes a direct current into exchange, and the battery 1 is connected to the fuel cell system 3 containing a carburetion part, a reforming section (not shown), etc. As this fuel cell system 3, various fuel cell systems, such as a phosphoric acid type, a melting carbonate type, a solid oxide type, and a solid polyelectrolyte membrane type, are used, for example. The battery 1 is connected to the battery remaining capacity arithmetic unit (State Of Charge) 4. The battery remaining capacity arithmetic unit 4 functions as a "rechargeable battery remaining capacity detection means" to detect the charge remaining capacity of the battery 1. That is, the battery remaining capacity arithmetic unit 4 calculates the electric power used from the battery 1 by the inverter 2 based on the time jitter of the terminal voltage of the battery 1, and current, and calculates the amount of used power. The output-value setpoint signal Q4 which shows the output value of the fuel cell system 3 to the battery remaining capacity arithmetic unit 4 is supplied from the fuel cell control unit 6, and the charging capacity of the battery 1 calculates based on this output-value setpoint signal Q4. The charge remaining capacity of the battery 1 can be calculated with sufficient accuracy from this calculated charging capacity and the above-mentioned amount of used power.

[0012]The battery remaining capacity arithmetic unit 4 detects the terminal voltage of the battery 1 in the case of being in a prescribed position about the charge remaining capacity of the battery 1, and it may be made to ask for it from this battery voltage. The battery remaining capacity arithmetic unit 4 measures the remaining capacity of an electrolysis solution, and it may be made to calculate the charge remaining capacity of the battery 1 by monitoring specific gravity change of a battery electrolysis solution with an optical detector. It may be made for the battery remaining capacity arithmetic unit 4 to calculate the charge remaining capacity of the battery 1 by measuring the discharging amount of the battery 1. It may be made for the battery remaining capacity arithmetic unit 4 to calculate the charge remaining capacity of the battery 1 from the discharge voltage and charging time at the time of battery discharge again.

[0013]The inverter 2 is arranged between the battery 1 and the motor M attached to the vehicles 11, and it is connected to the motor controlling device 8. As said motor M, a DC brushless motor is used, for example. The motor controlling device 8 carries out drive controlling of the inverter 2 according to the running command from the accelerator which is not illustrated. The inverter 2 is changing the direct current power from the battery 1 into alternating current power, and supplying the motor M under control of this motor controlling device 8, and is controlling the run of an electromobile. The electric vehicle controller 7 is realized by the microcomputer provided with CPU

(central processing unit), ROM (read only memory) in which various programs and data were stored, RAM (random access memory) used as working area, etc., for example. The flag field for making the 1st according to state of battery 1 to 3rd flag one [the flag] and turn off is secured to RAM.
[0014]The electric vehicle controller 7 controls the electromobile whole system, and. According to the battery remaining capacity Q1 calculated with the battery remaining capacity arithmetic unit 4, system combined efficiency supplies the output-value switching signal Q5 for changing the output value of the fuel cell system 3 to the fuel cell control unit 6 in the range which is 30 to 40%. the output-value switching signal Q5 outputted from the electric vehicle controller 7 -- three kinds, Q53, Q55, and Q510, -- existing . These output-value switching signals Q53, Q55, and Q510 are signals which direct that the fuel cell system 3 drives at the output of 3 kW, 5 kW, and 10 kW to the fuel cell control unit 6, respectively. Thus, according to the state of the battery 1, as shown in drawing 4, the electric vehicle controller 7 chooses the range with high system combined efficiency (for example, 30 to 40% of range), and directs the output of the fuel cell system 3. Here the output of 10 kW (it is about 30% of efficiency in the portion of the numerals C1 of drawing 4) of the fuel cell system 3, Although some system combined efficiency is low compared with 3 kW (it is about 32% of efficiency in the portion of the numerals B1 of drawing 4), or 5 kW (it is about 33% of efficiency in the portion of the numerals A1 of drawing 4), it is upper limit permissible as an efficient range.
[0015]It may be performed as follows when opting for three kinds of outputs of the fuel cell system 3. That is, the motor controlling device 8 supplies the required driving power signal Q2 equivalent to the electric power of the battery 1 used by driving the motor M via the inverter 2 to the electric vehicle controller 7. And the electric vehicle controller 7 functions also as a "rechargeable battery remaining capacity detection means" to compute the rate of change of the charge remaining capacity of the battery 1, and outputs the output-value switching signal Q5 according to the computed rate of change. When computing the rate of change of the charge remaining capacity of the battery 1, it may be made to compute the electric vehicle controller 7 from the required driving power signal Q2 supplied from the output-value switching signal Q5 and the motor controlling device 8 which are supplied to the fuel cell control unit 6.
[0016]The electric vehicle controller 7 is provided with the fuel cell output-value deciding part 7a which functions as a "fuel cell output control means", respectively, the fuel cell output-value continuous control part 7b, and the fuel cell output-value operation part 7c. Based on the charging rate of the battery 1 for which the battery remaining capacity arithmetic unit 4 asked, the fuel cell output-value deciding part 7a, The output value (10 3 kW, 5 kW, or kW) of the fuel cell system 3 for charging the battery 1 is determined, and it sends out to the fuel cell control unit 6 by making the determination output value into the output-value switching signal Q5. The fuel cell output-value continuous control part 7b is controlled to continue the state where it charged at the output of 3 kW, 5 kW, and 10 kW based on the output-value switching signal Q5 till then, when the electric power switch 13 for a drive (ignition key) which functions as a part of "permission means" is come by off. An ignition key means the on/off switch of a main power supply in this example here.
[0017]The time when the fuel cell output-value operation part 7c was inputted from the input device 12 when the ignition key 13 was come by off, Based on the battery remaining capacity Q1 supplied from the battery remaining capacity arithmetic unit 4, the output value of the fuel cell system 3 needed in order to make the battery 1 into a full charge (for example, 90% charge) within said time is calculated.
[0018]On the other hand, the fuel cell system 3 is connected to the methanol tank 5 in which methanol was stored. The fuel cell system 3 and the methanol tank 5 are connected to the fuel cell control unit 6. The fuel cell control unit 6 so that the output from the fuel cell system 3 may turn into an output according to the contents of the output-value switching signal Q5 supplied from the electric vehicle controller 7, The methanol input adjust signal Q3 is sent out to the methanol tank 5, and the output-value setpoint signal Q4 is sent out to the fuel cell system 3. From the methanol tank 5, methanol according to the methanol input adjust signal Q3 is supplied to the fuel cell system

3. At the fuel cell system 3, the methanol supplied is reformed and the battery 1 is charged with the output according to the charge remaining capacity and the rate of change of the battery 1 by the oxygen supply according to the output-value setpoint signal Q4, etc.
[0019]Next, operation of the hybrid power supply device H constituted in this way is explained.
(1) The book operation of operation at the time of one of an ignition key (at the time of drive [of the motor M] possible), When the ignition key 13 is one (by stepping on the accelerator when the motor M can be driven) Driver voltage is added to the motor M and the charging capacity (charging rate) of the battery 1 is detected in the state where a run of vehicles is attained, and it is an output for charge corresponding to the detected charging rate, and is a case where the fuel cell system 3 is worked efficiently. In [as shown in drawing 2] the state (state of a motor which can be driven) of one of the ignition key 13, From the amount of used power of the battery 1, and the charging capacity from the fuel cell system 3, the battery remaining capacity arithmetic unit 4 detects the charging capacity (charging rate) of the battery 1, and supplies the fuel cell output-value deciding part 7a of the electric vehicle controller 7 (Step 1). The 1st flag (90% or less flag) is set to the flag field secured to (Step 2; Y) and RAM which is not illustrated when the detected charging rate was 90% or less (Step 3), It confirms whether the charging rate of the battery 1 is 70% or less (Step 4), and the 2nd flag (70% or less flag) is set to 70% or less of case (Step 5). Subsequently, it confirms whether a charging rate is 60% or less (Step 6), and the 3rd flag (60% or less flag) is set to 60% or less of case (Step 7).
[0020]And when each flag is "one, OFF, and OFF", respectively, more charging rates of (Step 8) and the battery 1 than 70% are in 90% or less of comparatively high state. For this reason, since it is not necessary to charge the battery 1 quickly, the fuel cell output-value deciding part 7a of the electric vehicle controller 7 supplies the output-value switching signal Q53 to the fuel cell control unit 6 so that it may be set to 3 kW with the highest efficiency of the fuel cell system 3, and the lowest output. The output-value setpoint signal Q4 which is equivalent to 3 kW from the fuel cell control unit 6 is supplied to the fuel cell system 3 by this, and the battery 1 is charged with the most efficient output of 3 kW (it is about 33% of efficiency in the portion of the numerals A1 of drawing 4) (Step 9).
[0021]At Step 8, when each flag is not "one, OFF, and OFF", respectively, it is confirmed [(Step 8; N) and] whether each flag is "one, one, and OFF" (Step 13). More charging rates of the battery 1 than 60% are in 70% or less of state, and when it is "one, one, and OFF" (step 13;Y), although it is not necessary to charge quickly, this is in the state whose battery charging capacity is decreasing to some extent. For this reason, although the fuel cell output-value deciding part 7a of the electric vehicle controller 7 is a high output somewhat, it supplies the output-value switching signal Q55 to the fuel cell control unit 6 so that it may become an output of 5 kW corresponding to the mean value of the range whose system combined efficiency is 30 to 40%. By this, the fuel cell system 3 charges the battery 1 with an output with an output [corresponding to the mean value of said system combined efficiency range] of 5 kW (it is about 32% of efficiency in the portion of the numerals B1 of drawing 4) (Step 14).
[0022]When each flag is not "one, one, and OFF" at Step 13, respectively, it is confirmed [(Step 13; N) and] whether each flag is "one, one, and one", respectively (Step 15). The charging rate of the battery 1 is 60% or less, and since the charging capacity of the battery 1 is becoming less to some extent, before being in an overdischarge state, it is necessary to perform a certain amount of charge, when it is "one, one, and one" (step 15;Y). For this reason, although efficiency is the lowest among said system combined efficiency ranges, the fuel cell output-value deciding part 7a chooses the output of 10 kW in tolerance level, and the corresponding output-value switching signal Q510 supplies it to the fuel cell control unit 6 from the electric vehicle controller 7. By this, the fuel cell system 3 charges the battery 1 with the output of 10 kW (it is about 30% of efficiency in the portion of the agreement C1 of drawing 4) used as the low efficiency of the efficient range (Step 16).
[0023]Since (Step 15; N) and the charging rate are not less than 90% when each flag is not "one,

one, and one" in Step 15, respectively, the return of the stop processing of the fuel cell system 3 is performed and (Step 12) carried out. And detect battery charging capacity again (Step 1), and since a charging rate is not 90% or less in Step 2 (step 2;N), The 1st flag, the 2nd flag, and the 3rd flag are cleared one by one (Step 18 – Step 20), and the return of the fuel cell stop processing is performed and (Step 21) carried out. If it processes as mentioned above, the fuel cell system 3 can be generated in an efficient portion (30 to 33%), and the battery 1 can be charged efficiently. In this example of operation, although the output value of the fuel cell system 3 was determined according to the "charging rate" of the battery 1, the "rate of change" of the charge remaining capacity of the battery 1 may determine an output value like the above-mentioned.

[0024](2) The book operation of operation at the time of OFF of the ignition key 13 (at the time of drive un-granting a permission of the motor M) is operation when the ignition key 13 is turned OFF after the operation at the time of one of the above-mentioned ignition key 13.

** The setting input of the charging time may be carried out to the case where the output of the fuel cell system 3 till then is continued automatically, from the input device 12 with ** manual type.

** Operation of ****** in the case of continuing the output of the fuel cell system 3 automatically is a case where (Step 10; Y) is not carried out when the ignition key 13 is turned off at Step 10, and the input of charging time is not carried out from the input device 12 into fixed time.

[0025]As shown in drawing 2 and drawing 3, when the electric vehicle controller 7 detects OFF (IG OFF) of the ignition key 13 to an ignition key, the battery 1 is automatically charged using the time at the time (namely, under parking) of drive un-granting a permission of (Step 10; Y) and the motor M. Therefore, the battery remaining capacity arithmetic unit 4 detects battery charging capacity (Step 11), At 90% or less, in (Step 12; Y) and fixed time, when a charging rate does not have a setting input of charging time in the input device 12, it returns to (Step 17; N) and Step 8, and it checks the flag at the time of turning OFF the ignition key 13. Even if each flag stored in RAM turns OFF the ignition key 13, it backs up the state (state of either Step 8, Step 13 or Step 15) till then.

[0026]When each flag is "one, OFF, and OFF", respectively, namely, the (step 8; Y), "3-kW charge is continued like the above-mentioned (Step 9) One, one, In being OFF", it continues 5-kW charge like (Step 13; Y) and the above-mentioned (Step 14), and in being "one, one, and one", it continues 10-kW charge like (Step 15; Y) and the above-mentioned (Step 16). And battery remaining capacity is detected at Step 11, when a charging rate exceeds 90%, it shifts to (Step 12; N) and Step 18, and each flag is cleared one by one (Step 18 – Step 20), and the return of the stop processing of the fuel cell system 3 is performed and (Step 21) carried out.

[0027]** When carrying out the setting input of the charging time from the input device 12 with a manual type, this operation is a case where the input of charging time is carried out from the input device 12 into fixed time, when the ignition key 13 is turned off at Step 10 (step 10;Y). As shown in drawing 2 and drawing 3, after the ignition key 13 was turned off (step 10;Y), Battery remaining capacity is detected (Step 11), and when a charging rate is 90% or less, (Step 12; Y) and the electric vehicle controller 7 confirm whether the input of charging time is in fixed time from the input device 12 (Step 17).

[0028]And when there is an input, (Step 17; Y) and the fuel cell output-value operation part 7c of the electric vehicle controller 7, The output value of the fuel cell system 3 required to charge the remaining capacity value of a battery not less than 90% is calculated from the charging time inputted from the input device 12, and the battery remaining capacity which was detected in Step 11 and supplied from the battery remaining capacity arithmetic unit 4 (Step 22). The output value calculated at Step 22 is supplied to the fuel cell control unit 6 as the output-value switching signal Q5, and the methanol input adjust signal Q3 and the output-value setpoint signal Q4 are supplied to the methanol tank 5 and the fuel cell system 3 from the fuel cell control unit 6, respectively. The fuel cell system 3 charges the battery 1 with the output according to directions of the output-value switching signal Q5 (Step 23), and the electric vehicle controller 7 completes charge, when battery

remaining capacity becomes not less than 90% (Step 24). And the electric vehicle controller 7 clears each flag one by one (Step 18 – Step 20), and performs and (Step 21) carries out the return of the stop processing of the output of the fuel cell system 3.

[0029]If it does in this way, the parking duration in the case of shopping, etc. (for example, 4 hours) will be inputted by the driver from the input device 12, for example, and if battery remaining capacity is 60% at this time, although efficiency is inferior, boost charge of it will be carried out a little at 10 kW of tolerance level. Since the parking duration [it has come to office to office] of a between (for example, 8 hours) is inputted, and there is time of enough if battery remaining capacity is 60%, it charges at efficient 3 kW. And in the case of the former, since the remaining capacity value of the battery 1 is charged to 90% if it returns to an electromobile after 4-hour progress, sufficient distance which can be run is securable.

[0030]In each [of 4 hours, 6 hours, 8 hours, and 8 hours or more] case, the charging time in the case of a manual type could be made to carry out a setting input, but except such time width may be sufficient as it, and it may enable it to set up charging time by 30 minutes or one time basis in this example. Although the output value in the case of a manual type was 3 kW, 5 kW, and 10 kW in this example, it may enable it to set up the output of the fuel cell system 3 per kW. In the case of a manual type, it is possible that the result of an operation of the fuel cell output-value operation part 7c exceeds the output which is 10 kW depending on input time. thus -- since fuel efficiency worsens when the result of an operation exceeds 10 kW, an output value is uniformly set as 10 kW -- also carrying out -- it is good. According to the input from the electric power switch 13 for a drive (ignition key), the open/close switch (not shown) which functions as an "opening and closing means" between the battery 1 and the inverter 2 is arranged again, and this open/close switch may close [may be and] it made to be opened.

[0031]

[Effect of the Invention]As explained above, when not permitting the drive of a motor according to the invention according to claim 1, a rechargeable battery can be charged using drive the time of not granting a permission of a motor. According to the invention according to claim 2, permission and un-granting a permission of a motor drive are realized by the electric power switch for a drive, and an opening and closing means. According to the invention according to claim 3, the drive of a motor is not permitted, and when the charge remaining capacity of a rechargeable battery is below a predetermined value, it charges automatically from a fuel cell. According to the invention according to claim 4, the drive of a motor is not permitted, and when the charge remaining capacity of a rechargeable battery is below a predetermined value, charge is performed from a fuel cell with the value corresponding to rechargeable battery remaining capacity. According to the invention according to claim 5, when not permitting the drive of a motor, battery remaining capacity can be made into a full charge after the time which carried out the indicating input from the charging time input means.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a system configuration figure of the electromobile with which the hybrid power supply device in one working example of this invention was applied.
[Drawing 2]It is a flow chart which shows operation of the charging treatment of the battery of the same as the above and a hybrid power supply device.
[Drawing 3]It is a flow chart of a continuation of the flow chart shown in the same as the above and drawing 2.
[Drawing 4]It is a figure showing the fuel cell output-system combined efficiency characteristic in the fuel cell used for the same as the above and a hybrid power supply device.
[Description of Notations]
M Vehicles motor
1 Battery (rechargeable battery)
3 Fuel cell system
4 Battery remaining capacity arithmetic unit (rechargeable battery remaining capacity detection means)
6 Fuel cell control unit
7 Electric vehicle controller
7a Fuel cell output-value deciding part (fuel cell output control means)
7b Fuel cell output-value continuous control part (fuel cell output control means)
7c Fuel cell output-value operation part (fuel cell output control means)
8 Motor controlling device
12 Input device (charging time input means)
13 Ignition key (electric power switch for a drive)

[Translation done.]

* NOTICES *

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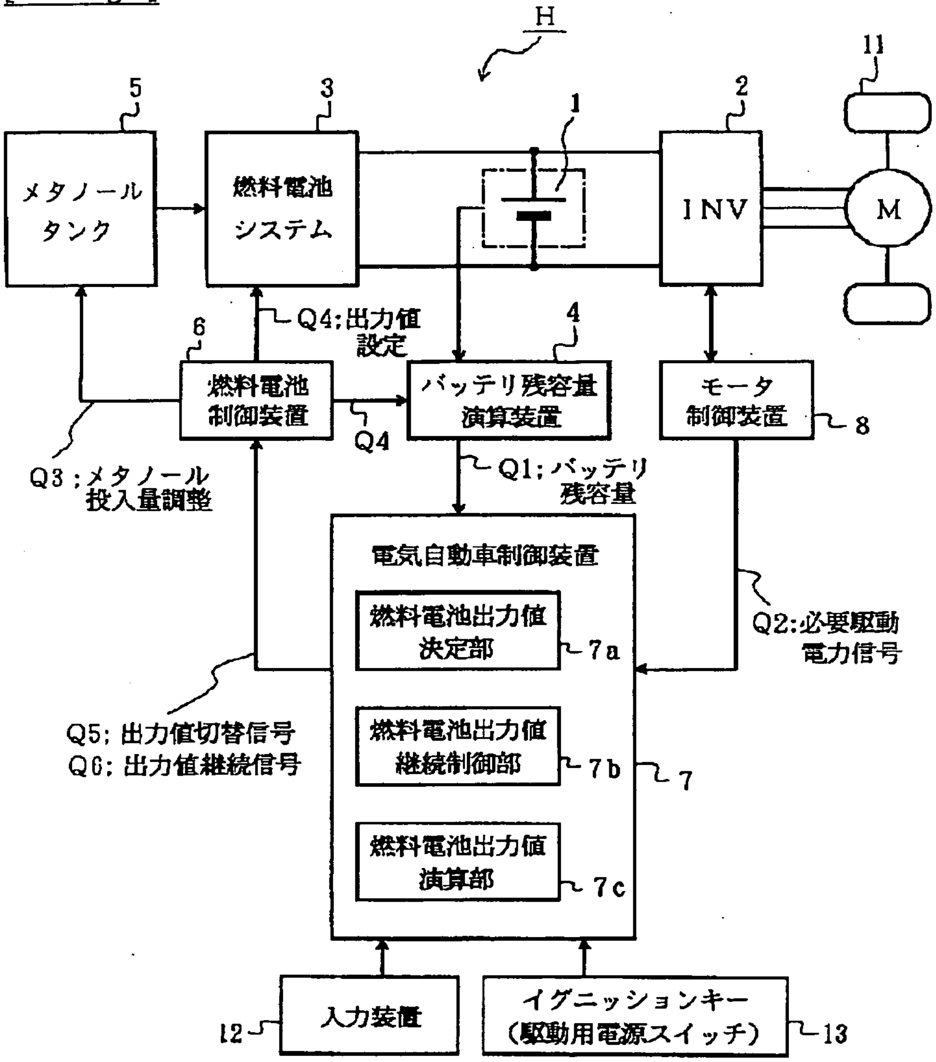
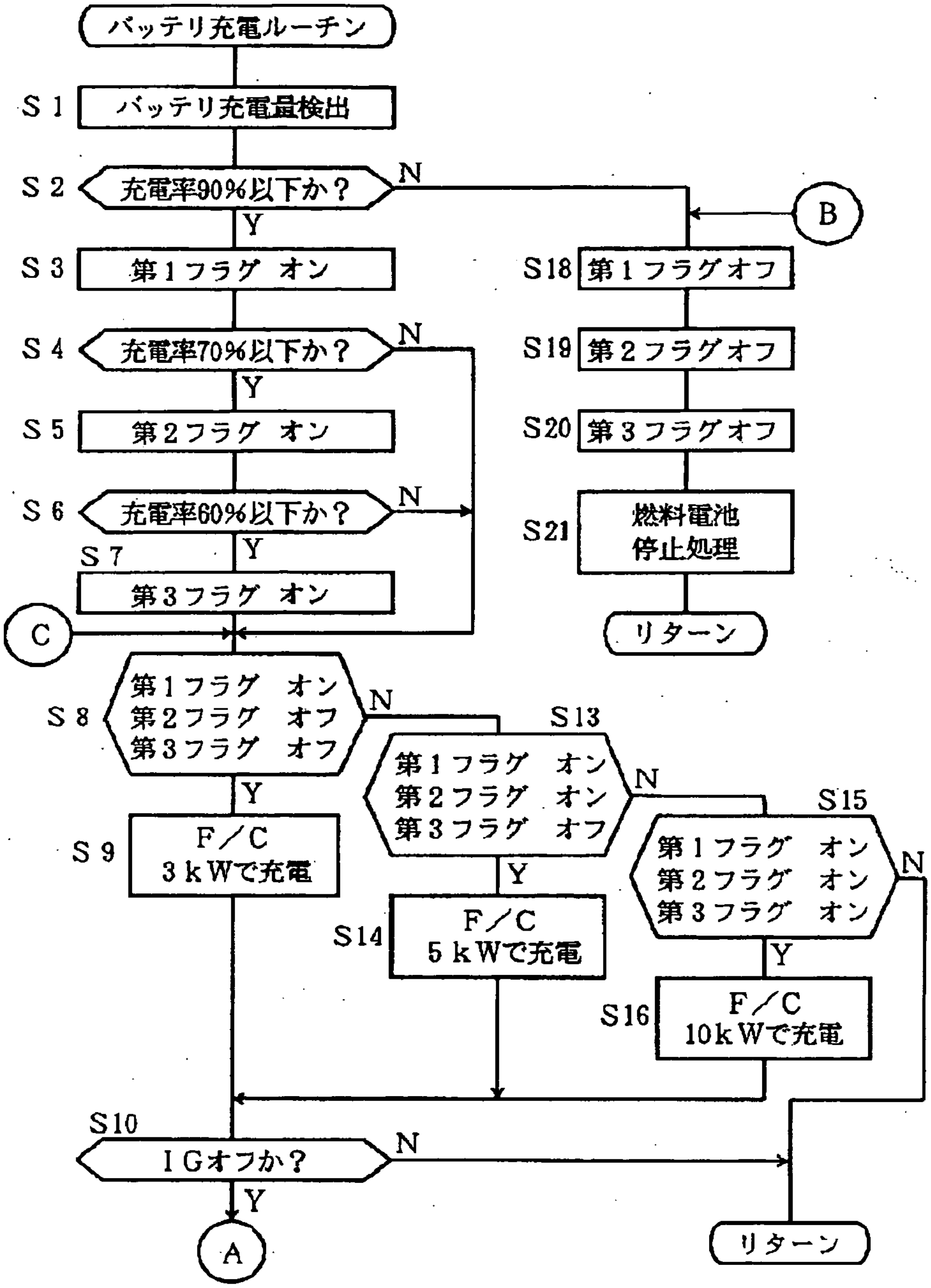
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

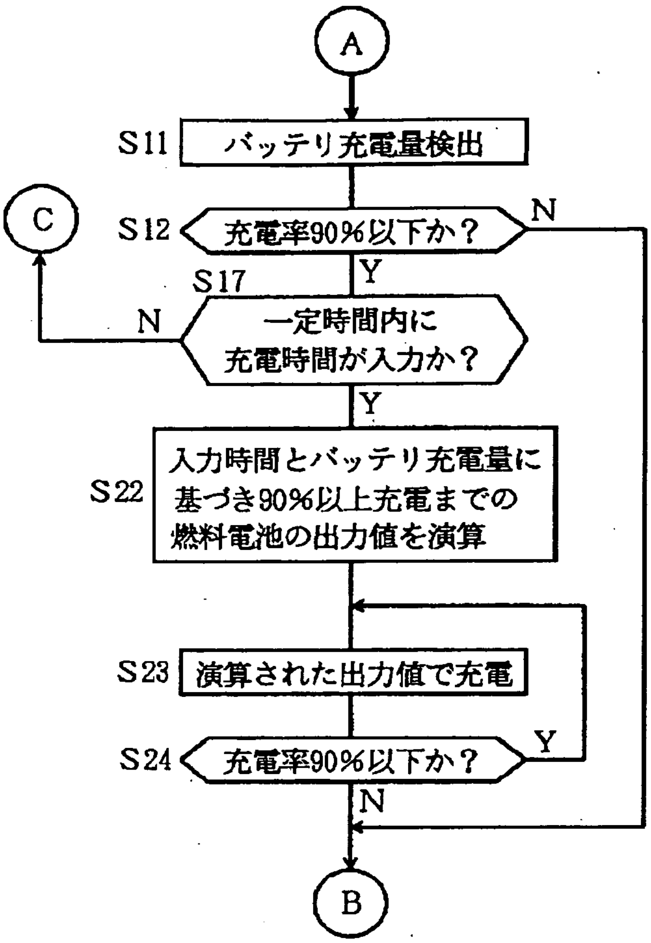
[Drawing 1]



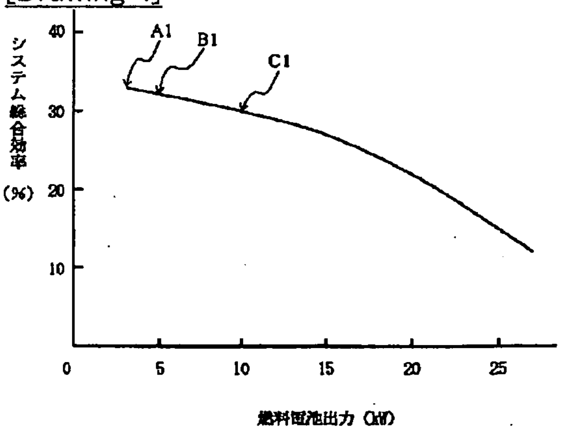
[Drawing 2]


バッテリ充電ルーチン
S1 バッテリ充電量検出
S2 充電率90%以下か？
S3 第1フラグ オン
S4 充電率70%以下か？
S5 第2フラグ オン
S6 充電率60%以下か？
S7 第3フラグ オン
S8 第1フラグ オン 第2フラグ オフ 第3フラグ オフ
S9 F／C 3kWで充電
S10 IGオフか？
S13 第1フラグ オン 第2フラグ オン 第3フラグ オフ
S14 F／C 5kWで充電
S15 第1フラグ オン 第2フラグ オン 第3フラグ オン
S16 F／C 10kWで充電
S18 第1フラグオフ
S19 第2フラグオフ
S20 第3フラグオフ
S21 燃料電池停止処理
リターン
Y
N
A
B
C

[Drawing 3]



[Drawing 4]



[Translation done.]

CORRECTION OR AMENDMENT

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10/48 P

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[Filing date]Heisei 13(2001) February 26 (2001.2.26)
[Amendment 1]
[Document to be Amended]Description
[Item(s) to be Amended]Claims
[Method of Amendment]Change
[Proposed Amendment]
[Claim(s)]

[Claim 1]A rechargeable battery which supplies electric power for motor drives,
A fuel cell which outputs electric power for charging this rechargeable battery,
A permission means to which a drive of said motor is permitted,
A detection means to detect whether this permission means is in an authorized state,
A hybrid power supply device having a fuel cell output control means which continues charge of said rechargeable battery by said fuel cell when this detection means detects un-granting a permission of a motor drive.
[Claim 2]The hybrid power supply device according to claim 1, wherein said permission means is an ignition key.
[Claim 3]An opening and closing means in which said permission means opens and closes connection between said motor and a rechargeable battery,
The hybrid power supply device according to claim 1 provided with an electric power switch for a drive which operates this opening and closing means.
[Claim 4]It has a rechargeable battery remaining capacity detection means to detect charge remaining capacity of said rechargeable battery,
The hybrid power supply device according to claim 1 when said fuel cell output control means is [said rechargeable battery charge remaining capacity] below a predetermined value, wherein it performs an output for charge from said fuel cell.
[Claim 5]It has a rechargeable battery remaining capacity detection means to detect charge remaining capacity of said rechargeable battery,
The hybrid power supply device according to claim 1 when said fuel cell output control means is [rechargeable battery charge remaining capacity] below a predetermined value, wherein it performs an output for charge from a fuel cell with a value corresponding to said rechargeable battery remaining capacity.
[Claim 6]A charging time input means which carries out the setting input of the time to charge a rechargeable battery with the output of said fuel cell,
It has rechargeable battery remaining capacity detection which detects charge remaining capacity of said rechargeable battery,
Remaining capacity of a rechargeable battery from which said fuel cell output control means was detected by said rechargeable battery remaining capacity detection means when un-granting a permission of a drive was detected by said detection means, The hybrid power supply device according to claim 1, wherein said rechargeable battery calculates an output value which can be charged to a predetermined remaining capacity value and controls an output of said fuel cell based on charging time inputted from said charging time input means.
[Amendment 2]
[Document to be Amended]Description
[Item(s) to be Amended]0004
[Method of Amendment]Change
[Proposed Amendment]
[0004]
[Problem(s) to be Solved by the Invention]However, in the hybrid power supply device indicated by said gazette, when battery residual quantity became less than 50%, since output voltage was insufficient, there was a possibility that a motor might not drive at the time of restart. When you are going to make it drive a motor only with the output of a fuel cell, the output of a fuel cell needs the output of not less than 10 kW. However, in order to obtain the output of not less than 10 kW, when the fuel cell became huge and the practical use side was taken into consideration, it was difficult [it] to attach to an electromobile. When it was going to charge the battery of the electromobile, the electromobile was driven to the stand etc. which have a battery charging equipment, for example, and kana **** did not become but was conventionally troublesome for the driver. Therefore, it is very convenient if it can make it possible to charge a battery during parking of an electromobile at

arbitrary places. Then, the purpose of this invention is to provide the hybrid power supply device which can charge a rechargeable battery using the time when the drive of the motor is not permitted.
[Amendment 3]
[Document to be Amended]Description
[Item(s) to be Amended]0005
[Method of Amendment]Change
[Proposed Amendment]
[0005]
[Means for Solving the Problem]A rechargeable battery which supplies electric power for motor drives in the invention according to claim 1, A fuel cell which outputs electric power for charging this rechargeable battery, and a permission means to which said motor drive is permitted, It has a detection means to detect whether this permission means is in an authorized state, and a fuel cell output control means which continues charge of said rechargeable battery by said fuel cell when this detection means detects un-granting a permission of a motor drive, and said purpose is attained. In the invention according to claim 2, said permission means is characterized by being an ignition key. In the invention according to claim 3, said permission means is provided with said motor, an opening and closing means which opens and closes connection between rechargeable batteries, and an electric power switch for a drive which operates this opening and closing means, and attains said purpose.
[Amendment 4]
[Document to be Amended]Description
[Item(s) to be Amended]0006
[Method of Amendment]Change
[Proposed Amendment]
[0006]In the invention according to claim 4, it has a rechargeable battery remaining capacity detection means to detect the charge remaining capacity of said rechargeable battery, and when said rechargeable battery charge remaining capacity is below a predetermined value, said fuel cell output control means is performing the output for charge from said fuel cell, and attains said purpose. In the invention according to claim 5, it has a rechargeable battery remaining capacity detection means to detect the charge remaining capacity of said rechargeable battery, and said fuel cell output control means is performing the output for charge from a fuel cell with the value corresponding to said rechargeable battery remaining capacity, when rechargeable battery charge remaining capacity is below a predetermined value, and it attains said purpose.
[Amendment 5]
[Document to be Amended]Description
[Item(s) to be Amended]0007
[Method of Amendment]Change
[Proposed Amendment]
[0007]The charging time input means which carries out the setting input of the time to charge a rechargeable battery with the output of said fuel cell in the invention according to claim 6, Have the rechargeable battery remaining capacity detection which detects the charge remaining capacity of said rechargeable battery, and said fuel cell output control means, The remaining capacity of the rechargeable battery detected by said rechargeable battery remaining capacity detection means when un-granting a permission of a drive was detected by said detection means, Said purpose is attained because said rechargeable battery calculates the output value which can be charged to a predetermined remaining capacity value and controls the output of said fuel cell based on the charging time inputted from said charging time input means.
[Amendment 6]
[Document to be Amended]Description

[Item(s) to be Amended]0008
[Method of Amendment]Change
[Proposed Amendment]
[0008]
[Function]In the hybrid power supply device according to claim 1, a rechargeable battery drives a motor and a fuel cell charges a rechargeable battery. A permission means determines the propriety of a drive of a motor. A detection means detects the propriety of the motor drive of a permission means. And a fuel cell output control means is controlled to charge a rechargeable battery with the output of a fuel cell, when a detection means detects un-granting a permission of a motor drive. In the invention according to claim 2, a motor drive is permitted by the ignition key as a permission means. In the hybrid power supply device according to claim 3, a permission means is provided with said motor, the opening and closing means which opens and closes connection between rechargeable batteries, and the electric power switch for a drive which operates this opening and closing means, and the propriety of permission of a motor drive is determined by operation of the electric power switch for a drive. In the hybrid power supply device according to claim 4, a rechargeable battery remaining capacity detection means detects the charge remaining capacity of a rechargeable battery. A fuel cell output control means performs the output for charge from a fuel cell, when the rechargeable battery remaining capacity which the rechargeable battery remaining capacity detection means detected becomes below a predetermined value.
[Amendment 7]
[Document to be Amended]Description
[Item(s) to be Amended]0009
[Method of Amendment]Change
[Proposed Amendment]
[0009]In the hybrid power supply device according to claim 5, a rechargeable battery remaining capacity detection means detects the charge remaining capacity of a rechargeable battery. A fuel cell output control means performs the output for charge from a fuel cell with the value corresponding to rechargeable battery remaining capacity, when the rechargeable battery remaining capacity which the rechargeable battery remaining capacity detection means detected becomes below a predetermined value. In the hybrid power supply device according to claim 6, time to charge a rechargeable battery is inputted from a charging time input means. A rechargeable battery remaining capacity detection means detects rechargeable battery remaining capacity. And when a detection means detects un-granting a permission of a drive of a motor, a fuel cell output control means, Based on the rechargeable battery remaining capacity value which the rechargeable battery remaining capacity detection means detected, and the charging time inputted from the charging time input means, the output value of the fuel cell taken for a rechargeable battery to be charged by the predetermined remaining capacity value (for example, full charge) is calculated.
[Amendment 8]
[Document to be Amended]Description
[Item(s) to be Amended]0031
[Method of Amendment]Change
[Proposed Amendment]
[0031]
[Effect of the Invention]As explained above, when not permitting the drive of a motor according to the invention according to claim 1, a rechargeable battery can be charged using drive the time of not granting a permission of a motor. According to the invention according to claim 2, permission and un-granting a permission of a motor drive are realized by the ignition key. According to the invention according to claim 3, permission and un-granting a permission of a motor drive are realized by the electric power switch for a drive, and an opening and closing means. According to the invention according to claim 4, the drive of a motor is not permitted, and when the charge remaining

capacity of a rechargeable battery is below a predetermined value, it charges automatically from a fuel cell. According to the invention according to claim 5, the drive of a motor is not permitted, and when the charge remaining capacity of a rechargeable battery is below a predetermined value, charge is performed from a fuel cell with the value corresponding to rechargeable battery remaining capacity. According to the invention according to claim 6, when not permitting the drive of a motor, battery remaining capacity can be made into a full charge after the time which carried out the indicating input from the charging time input means.

[Translation done.]

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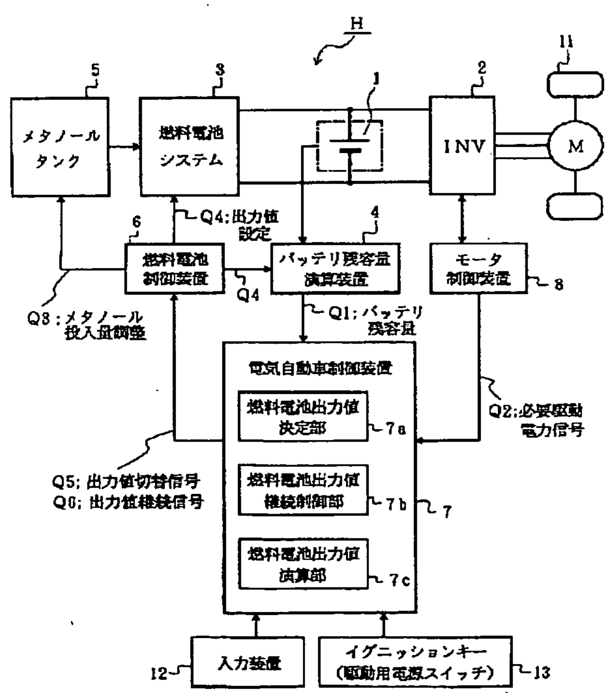
(54)【発明の名称】　ハイブリッド電源装置

(57)【要約】

【目的】　モータの駆動非許可の状態であっても、燃料電池を動作させて二次電池を充電可能なハイブリッド電源装置を提供する。

【構成】　燃料電池出力値演算部7ｃは、入力装置１２から入力された充電時間と、バッテリ残容量演算装置４からのバッテリ残容量情報とに基づき、バッテリ１を満充電するのに必要な燃料電池システム３の出力値を演算する。バッテリ１は、この出力値で充電されるので、入力された充電時間後には満充電状態となる。



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【特許請求の範囲】

【請求項１】　モータ駆動用の電力を供給する二次電池と、
この二次電池を充電するための電力を出力する燃料電池と、
前記モータの駆動を許可する許可手段と、
この許可手段が許可状態にあるか否かを検出する検出手段と、
この検出手段がモータ駆動の非許可を検出した場合に、前記燃料電池による前記二次電池の充電を継続する燃料電池出力制御手段とを備えたことを特徴とするハイブリッド電源装置。

【請求項２】　前記許可手段は、前記モータと二次電池間の接続を開閉する開閉手段と、この開閉手段を作動させる駆動用電源スイッチとを備えたことを特徴とする請求項1記載のハイブリッド電源装置。

【請求項３】　前記二次電池の充電残容量を検出する二次電池残容量検出手段を備え、
前記燃料電池制御手段は、前記二次電池充電残容量が所定値以下の場合に、前記燃料電池から充電用出力を行うことを特徴とする請求項1記載のハイブリッド電源装置。

【請求項４】　前記二次電池の充電残容量を検出する二次電池残容量検出手段を備え、
前記燃料電池出力制御手段は、二次電池充電残容量が所定値以下の場合に前記二次電池残容量に対応した値で燃料電池から充電用出力を行うことを特徴とする請求項1記載のハイブリッド電源装置。

【請求項５】　前記燃料電池の出力により二次電池を充電する時間を設定入力する充電時間入力手段と、
前記二次電池の充電残容量を検出する二次電池残容量検出とを備え、
前記燃料電池制御手段は、前記検出手段によって駆動の非許可が検出された場合に、前記二次電池残容量検出手段で検出された二次電池の残容量と、前記充電時間入力手段から入力された充電時間とに基づき、前記二次電池が所定残容量値まで充電可能な出力値を演算して前記燃料電池の出力を制御することを特徴とする請求項1記載のハイブリッド電源装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、ハイブリッド電源装置に係り、例えば、電気自動車のモータ駆動用等に使用されるハイブリッド電源装置に関する。

【０００２】

【従来の技術】近年、地球環境保護の観点から、有害ガスの発生源となるガソリンエンジン等を駆動源とせず、クリーンな電力によって車両を駆動させる電気自動車が注目されている。ところで、電気自動車に使用される二次電池は、出力容量は大きいが、エネルギ容量が比較的

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小さい。そのため、二次電池を電源とする電気自動車では、一回の充電によって走行可能な距離が１００Ｋｍ前後であり、ガソリンエンジンで走行する現行のガソリン車の一回の満タン後の走行距離が４００～５００Ｋｍであるのと比較すると、かなりの差がある。そこで、電気自動車の走行可能距離を延ばすために、出力容量は小さいがエネルギ容量が大きい燃料電池と、二次電池とを組み合わせたハイブリッド電源装置が開発されている。このようなハイブリッド電源装置は、試験的に例えば、バスやゴルフカートに使用されている。

【０００３】従来、かかるハイブリッド電源装置を電気自動車に適用した例として、特開平３－２７６５７３号公報に開示されたものが知られている。この公報に開示された電気自動車は、通常走行時には燃料電池の出力を使用し、電気自動車を急加速するなどの負荷急増時に燃料電池の出力不足をバックアップするためにバッテリを使用している。そして、軽負荷時には燃料電池の余剰電力をバッテリの充電に使用している。

【０００４】

【発明が解決しようとする課題】しかし、前記公報に開示されたハイブリッド電源装置においては、バッテリ残量が５０％未満になると出力電圧不足のために、再始動時にモータが駆動しないおそれがあった。また、燃料電池の出力のみでモータを駆動させようとすると、燃料電池の出力は１０ｋＷ以上の出力を必要とする。しかし、１０ｋＷ以上の出力を得るためには、燃料電池が巨大となり、実用面を考慮すると電気自動車に取り付けるのが困難であった。また、従来は電気自動車のバッテリを充電しようとすると、例えばバッテリ充電設備のあるスタンド等まで電気自動車を運転していかなければならず、運転者にとって煩わしかった。従って、任意の場所で電気自動車の駐車中にバッテリを充電できるようにできれば、大変便利である。そこで、本発明の目的は、モータが停止中の時間を利用してバッテリの充電が可能なハイブリッド電源装置を提供することである。

【０００５】

【課題を解決するための手段】請求項１記載の発明では、モータ駆動用の電力を供給する二次電池と、この二次電池を充電するための電力を出力する燃料電池と、前記モータ駆動を許可する許可手段と、この許可手段が許可状態にあるか否かを検出する検出手段と、この検出手段がモータ駆動の非許可を検出した場合に、前記燃料電池による前記二次電池の充電を継続する燃料電池出力制御手段とを備えて、前記目的を達成する。請求項２記載の発明では、前記許可手段は、前記モータと二次電池間の接続を開閉する開閉手段と、この開閉手段を作動させる駆動用電源スイッチとを備えて、前記目的を達成する。

【０００６】請求項３記載の発明では、前記二次電池の充電残容量を検出する二次電池残容量検出手段を備え、

前記燃料電池制御手段は、前記二次電池充電残容量が所定値以下の場合に、前記燃料電池から充電用出力を行うことで、前記目的を達成する。請求項４記載の発明では、前記二次電池の充電残容量を検出する二次電池残容量検出手段を備え、前記燃料電池出力制御手段は、二次電池充電残容量が所定値以下の場合に前記二次電池残容量に対応した値で燃料電池から充電用出力を行うことで、前記目的を達成する。

【０００７】請求項５記載の発明では、前記燃料電池の出力により二次電池を充電する時間を設定入力する充電時間入力手段と、前記二次電池の充電残容量を検出する二次電池残容量検出とを備え、前記燃料電池制御手段は、前記検出手段によって駆動の非許可が検出された場合に、前記二次電池残容量検出手段で検出された二次電池の残容量と、前記充電時間入力手段から入力された充電時間とに基づき、前記二次電池が所定残容量値まで充電可能な出力値を演算して前記燃料電池の出力を制御することで、前記目的を達成する。

【０００８】

【作用】請求項１記載のハイブリッド電源装置では、二次電池がモータを駆動し、燃料電池が二次電池を充電する。許可手段は、モータの駆動の可否を決定する。検出手段は、許可手段のモータ駆動の可否を検出する。そして、燃料電池出力制御手段は、検出手段がモータ駆動の非許可を検出した場合に、燃料電池の出力で二次電池を充電するように制御する。請求項２記載のハイブリッド電源装置では、許可手段は、前記モータと二次電池間の接続を開閉する開閉手段と、この開閉手段を作動させる駆動用電源スイッチとを備え、駆動用電源スイッチの動作によりモータ駆動の許可の可否が決定される。請求項３記載のハイブリッド電源装置では、二次電池残容量検出手段が、二次電池の充電残容量を検出する。燃料電池出力制御手段は、二次電池残容量検出手段が検出した二次電池残容量が所定値以下になった場合に、燃料電池から充電用出力を行う。

【０００９】請求項４記載のハイブリッド電源装置では、二次電池残容量検出手段が、二次電池の充電残容量を検出する。燃料電池出力制御手段は、二次電池残容量検出手段が検出した二次電池残容量が所定値以下になった場合に、二次電池残容量に対応した値で燃料電池から充電用出力を行う。請求項５記載のハイブリッド電源装置では、充電時間入力手段から、二次電池を充電する時間が入力される。二次電池残容量検出手段は、二次電池残容量を検出する。そして、検出手段がモータの駆動の非許可を検出した場合に、燃料電池出力制御手段は、二次電池残容量検出手段が検出した二次電池残容量値と、充電時間入力手段から入力された充電時間とに基づき、二次電池が所定残容量値（例えば、満充電）に充電されるまでに要する燃料電池の出力値を演算する。

【００１０】

【実施例】以下、本発明のハイブリッド電源装置における実施例を図１ないし図４を参照して詳細に説明する。図１は、本発明の実施例のハイブリッド電源装置Ｈを電気自動車に適用した場合のシステム構成図である。このハイブリッド電源装置Ｈは、電気自動車のモータＭを駆動するための電力を供給するための「二次電池」としてのバッテリ１を備えている。このバッテリ１としては、例えば、鉛酸蓄電池、ニッケルカドミウム電池、ナトリウム硫黄電池、リチウム二次電池、水素二次電池、レドックス型電池等の各種二次電池が使用される。このバッテリ１は、複数台の二次電池を直列に、又は直並列に接続することによって、例えば２４０〔Ｖ〕の電圧となるように構成されている。本実施例のバッテリ１では、１２〔Ｖ〕のバッテリセルが２０個直列に接続されている。

【００１１】バッテリ１は、直流を交流に変換するインバータ２に接続されると共に、気化部や改質部（図示せず）等を含む燃料電池システム３に接続されている。この燃料電池システム３としては、例えば、りん酸型、溶融炭酸塩型、固体電解質型、固体高分子電解質膜型等の各種燃料電池システムが使用される。また、バッテリ１は、バッテリ残容量演算装置（State Of Charge）４に接続されている。バッテリ残容量演算装置４は、バッテリ１の充電残容量を検出する「二次電池残容量検出手段」として機能するようになっている。すなわち、バッテリ残容量演算装置４は、バッテリ１の端子電圧と電流との時間変動に基づいて、インバータ２によってバッテリ１から使用される電力を演算し、使用電力量を求める。また、バッテリ残容量演算装置４には、燃料電池システム３の出力値を示す出力値設定信号Q4 が燃料電池制御装置６から供給され、この出力値設定信号Q4 に基づいてバッテリ１の充電容量が演算される。この演算した充電容量と、前述の使用電力量とから、バッテリ１の充電残容量を精度良く求めることができる。

【００１２】なお、バッテリ残容量演算装置４は、バッテリ１の充電残容量を、所定状態にある場合のバッテリ１の端子電圧を検出し、このバッテリ電圧から求めるようにしてもよい。また、バッテリ残容量演算装置４は、バッテリ電解液の比重変動を、光学検出器でモニタすることにより電解液の残容量を計測し、バッテリ１の充電残容量を求めるようにしてもよい。更に、バッテリ残容量演算装置４は、バッテリ１の放電量を計測することにより、バッテリ１の充電残容量を求めるようにしてもよい。更にまた、バッテリ残容量演算装置４は、バッテリ放電時の放電電圧と充電時間より、バッテリ１の充電残容量を求めるようにしてもよい。

【００１３】インバータ２は、バッテリ１と、車両１１に取り付けられたモータＭとの間に配置されると共に、モータ制御装置８に接続されている。前記モータＭとしては、例えば、ＤＣブラシレスモータが使用される。モ

ータ制御装置８は、図示しないアクセルからの走行指令に応じてインバータ２を駆動制御するようになっている。インバータ２は、このモータ制御装置８の制御の下、バッテリ１からの直流電力を交流電力に変換してモータMに供給することで、電気自動車の走行を制御している。電気自動車制御装置７は、例えばＣＰＵ（中央処理装置）、各種プログラムやデータが格納されたＲＯＭ（リード・オンリ・メモリ）、ワーキングエリアとして使用されるＲＡＭ（ランダム・アクセス・メモリ）等を備えたマイクロコンピュータによって実現される。ＲＡＭには、バッテリ１の状態に応じた第１から第３のフラグをオン、オフさせるためのフラグ領域が確保されている。

【００１４】電気自動車制御装置７は、電気自動車システム全体を制御すると共に、バッテリ残容量演算装置４で演算されるバッテリ残容量Q1 に応じて、システム総合効率が例えば３０～４０％の範囲で、燃料電池システム３の出力値を変化させるための出力値切替信号Q5 を燃料電池制御装置６に供給するようになっている。電気自動車制御装置７から出力される出力値切替信号Q5 は、Q53、Q55、Q510 の３種類存在する。これらの出力値切替信号Q53、Q55、Q510 は、それぞれ燃料電池システム３を出力３ｋW、５ｋW、１０ｋWで駆動するように燃料電池制御装置６に対して指示する信号である。このように電気自動車制御装置７は、バッテリ１の状態に応じて、図４に示すように、システム総合効率の高い範囲（例えば３０～４０％の範囲）を選択して燃料電池システム３の出力を指示する。ここで、燃料電池システム３の出力１０ｋW（図４の符号Ｃ１の部分で効率約３０％）は、３ｋW（図４の符号Ｂ１の部分で効率約３２％）や５ｋW（図４の符号Ａ１の部分で効率約３３％）に比べるとシステム総合効率は多少低いが、高効率な範囲として許容可能な上限値である。

【００１５】なお、燃料電池システム３の３種類の出力を決定する場合に、次のようにしてもよい。すなわち、モータ制御装置８は、インバータ２を介してモータMを駆動することにより使用されるバッテリ１の電力に相当する必要駆動電力信号Q2 を、電気自動車制御装置７に供給するようになっている。そして、電気自動車制御装置７は、バッテリ１の充電残容量の増減率を算出する「二次電池残容量検出手段」としても機能し、算出した増減率に応じて出力値切替信号Q5 を出力する。バッテリ1 の充電残容量の増減率を算出する場合に、電気自動車制御装置７は、燃料電池制御装置６に供給している出力値切替信号Q5 およびモータ制御装置８から供給される必要駆動電力信号Q2 から算出するようにしてもよい。

【００１６】また、電気自動車制御装置７は、それぞれ「燃料電池出力制御手段」として機能する燃料電池出力値決定部７ａと、燃料電池出力値継続制御部７ｂと、燃料電池出力値演算部７ｃとを備えている。燃料電池出力値決定部７ａは、バッテリ残容量演算装置４が求めたバッテリ１の充電率に基づいて、バッテリ１を充電するための燃料電池システム３の出力値（３ｋW、５ｋW、１０ｋWのいずれか）を決定し、その決定出力値を出力値切替信号Q5 として燃料電池制御装置６に送出する。また、燃料電池出力値継続制御部７ｂは、「許可手段」の一部として機能する駆動用電源スイッチ（イグニッションキー）１３がオフになった場合に、それまで出力値切替信号Q5 に基づいて出力３ｋW、５ｋW、１０ｋWで充電されていた状態を継続するように制御する。ここに、イグニッションキーは、本実施例においては、主電源のオン・オフスイッチを意味する。

【００１７】また、燃料電池出力値演算部７ｃは、イグニッションキー１３がオフになった場合に、入力装置１２から入力された時間と、バッテリ残容量演算装置４から供給されたバッテリ残容量Q1 とに基づいて、前記時間内にバッテリ１を満充電（例えば、９０％充電）にするために必要とする燃料電池システム３の出力値を演算する。

【００１８】一方、燃料電池システム３は、メタノールを貯えたメタノールタンク５に接続されている。燃料電池システム３とメタノールタンク５とは、燃料電池制御装置６に接続されている。燃料電池制御装置６は、燃料電池システム３からの出力が、電気自動車制御装置７から供給された出力値切替信号Q5 の内容に応じた出力になるように、メタノールタンク５にメタノール投入量調整信号Q3 を送出し、燃料電池システム３に出力値設定信号Q4 を送出する。メタノールタンク５からは、メタノール投入量調整信号Q3 に応じたメタノールが燃料電池システム３に供給される。燃料電池システム３では、供給されるメタノールを改質すると共に、出力値設定信号Q4 に応じた酸素供給等によって、バッテリ１の充電残容量や増減率に応じた出力でバッテリ１を充電するようになっている。

【００１９】次に、このように構成されたハイブリッド電源装置Hの動作について説明する。

（１）イグニッションキーのオン時（モータMの駆動可能時）の動作

本動作は、イグニッションキー１３がオンの場合（モータMが駆動可能な場合、即ち、アクセルを踏むことにより、モータMに駆動電圧が加わり、車両の走行が可能となる状態）に、バッテリ１の充電容量（充電率）を検出し、検出した充電率に対応した充電用出力で、効率良く燃料電池システム３を稼働する場合である。図２に示すように、イグニッションキー１３がオンの状態（モータの駆動可能状態）において、バッテリ１の使用電力量と燃料電池システム３からの充電容量とから、バッテリ残容量演算装置４がバッテリ１の充電容量（充電率）を検出し、電気自動車制御装置７の燃料電池出力値決定部７

ａに供給する（ステップ１）。検出した充電率が９０％以下の場合には（ステップ２；Ｙ）、図示しないＲＡＭに確保されたフラグ領域に第１フラグ（９０％以下フラグ）を立て（ステップ３）、更にバッテリ１の充電率が７０％以下か否かをチェックし（ステップ４）、７０％以下の場合には第２フラグ（７０％以下フラグ）を立てる（ステップ５）。次いで、充電率が６０％以下か否かをチェックし（ステップ６）、６０％以下の場合には第３フラグ（６０％以下フラグ）を立てる（ステップ７）。

【００２０】そして、各フラグがそれぞれ「オン、オフ、オフ」の場合には（ステップ８）、バッテリ１の充電率は７０％より多く９０％以下の比較的高い状態にある。このため、バッテリ１を急速に充電する必要がないので、電気自動車制御装置７の燃料電池出力値決定部７ａは、燃料電池システム３の効率が最も高く、出力が最も低い３ＫＷとなるように、出力値切替信号Q53を燃料電池制御装置６に供給する。これによって、燃料電池システム３には、燃料電池制御装置６から３ｋＷに相当する出力値設定信号Q4 が供給され、最も効率の良い３ｋＷ（図４の符号Ａ1の部分で効率約３３％）の出力でバッテリ１が充電される（ステップ９）。

【００２１】また、ステップ８で、各フラグがそれぞれ「オン、オフ、オフ」でない場合には（ステップ８；Ｎ）、各フラグが「オン、オン、オフ」であるか否かをチェックする（ステップ１３）。「オン、オン、オフ」である場合（ステップ１３；Ｙ）、バッテリ１の充電率が６０％より多く７０％以下の状態であり、これは、急速に充電する必要がないが、ある程度バッテリ充電容量が減ってきている状態である。このため電気自動車制御装置７の燃料電池出力値決定部７ａは、多少高い出力であるが、システム総合効率が３０～４０％の範囲の中間値に対応する出力５ＫＷとなるように、出力値切替信号Q55を燃料電池制御装置６に供給する。これによって、燃料電池システム３は、前記システム総合効率範囲の中間値に対応する出力５ｋＷ（図４の符号Ｂ1 の部分で効率約３２％）の出力でバッテリ１を充電する（ステップ１４）。

【００２２】また、ステップ１３で各フラグがそれぞれ「オン、オン、オフ」でない場合には（ステップ１３；Ｎ）、各フラグがそれぞれ「オン、オン、オン」であるか否かをチェックする（ステップ１５）。「オン、オン、オン」である場合（ステップ１５；Ｙ）、バッテリ１の充電率が６０％以下であり、バッテリ１の充電容量がある程度減ってきているので、過放電状態になる前にある程度の充電を行う必要がある。このため、燃料電池出力値決定部７ａは、前記システム総合効率範囲のうち、最も効率は低いが、許容範囲内にある１０ＫＷの出力を選択し、対応する出力値切替信号Q510 が電気自動車制御装置７から燃料電池制御装置６に供給する。これによって、燃料電池システム３は、高効率範囲の低効率となる１０ｋＷ（図４の符合Ｃ1 の部分で効率約３０％）の出力でバッテリ１を充電する（ステップ１６）。

【００２３】また、ステップ１５において各フラグがそれぞれ「オン、オン、オン」でない場合には（ステップ１５；Ｎ）、充電率が９０％以上であるので、燃料電池システム３の停止処理を行い（ステップ１２）、リターンする。そして、再度バッテリ充電容量を検出し（ステップ１）、ステップ２においては充電率が９０％以下ではないので（ステップ２；Ｎ）、第１フラグ、第２フラグ、第３フラグを順次オフにし（ステップ１８～ステップ２０）、燃料電池停止処理を行い（ステップ２１）、リターンする。以上のように処理すれば、燃料電池システム３を効率の良い部分（３０～３３％）で発電することができ、効率良くバッテリ１を充電することができる。なお、この動作例では、バッテリ１の「充電率」に応じて燃料電池システム３の出力値を決定したが、前述の如く、バッテリ１の充電残容量の「増減率」により、出力値を決定してもよい。

【００２４】（２）イグニッションキー１３のオフ時（モータＭの駆動非許可時）の動作

本動作は、前述のイグニッションキー１３のオン時の動作の後、イグニッションキー１３がオフにされた場合の動作であり、①自動的にそれまでの燃料電池システム３の出力を継続する場合と、②手動式で入力装置１２から充電時間を設定入力する場合とがある。

①自動的に燃料電池システム３の出力を継続する場合の動作

この動作は、ステップ１０でイグニッションキー１３がオフされた場合に（ステップ１０；Ｙ）、一定時間内に入力装置１２から充電時間の入力がされない場合である。

【００２５】図２および図３に示すように、電気自動車制御装置７がイグニッションキー１３からイグニッションキーのオフ（ＩＧオフ）を検出した場合は（ステップ１０；Ｙ）、モータＭの駆動非許可時（すなわち、駐車中）の時間を利用してバッテリ１を自動的に充電する。そのために、バッテリ残容量演算装置４はバッテリ充電容量を検出し（ステップ１１）、充電率が９０％以下で（ステップ１２；Ｙ）、一定時間内に入力装置１２に充電時間の設定入力がない場合には（ステップ１７；Ｎ）、ステップ８に戻り、イグニッションキー１３をオフにした際のフラグをチェックする。なお、ＲＡＭに格納されている各フラグは、イグニッションキー１３をオフにしても、それまでの状態（ステップ８又はステップ１３又はステップ１５のいずれかの状態）をバックアップするようになっている。

【００２６】すなわち、各フラグがそれぞれ「オン、オフ、オフ」の場合には（ステップ８；Ｙ）、前述と同様に３ｋＷの充電を継続し（ステップ９）、「オン、オ

ン、オフ」である場合には（ステップ１３；Ｙ）、前述と同様に５ｋＷの充電を継続し（ステップ１４）、「オン、オン、オン」である場合には（ステップ１５；Ｙ）、前述と同様に１０ｋＷの充電を継続する（ステップ１６）。そして、ステップ１１でバッテリ残容量を検出し、充電率が９０％を越えた場合には（ステップ１２；N）、ステップ１８に移行して各フラグを順次オフにし（ステップ１８～ステップ２０）、燃料電池システム３の停止処理を行い（ステップ２１）、リターンする。

【００２７】②手動式で入力装置１２から充電時間を設定入力する場合

この動作は、ステップ１０でイグニッションキー１３がオフされた場合（ステップ１０；Ｙ）、一定時間内に入力装置１２から充電時間の入力がされた場合である。図２および図３に示すように、イグニッションキー１３がオフされた後（ステップ１０；Ｙ）、バッテリ残容量を検出し（ステップ１１）、充電率が９０％以下の場合には（ステップ１２；Ｙ）、電気自動車制御装置７が、一定時間内に入力装置１２から充電時間の入力があるか否かをチェックする（ステップ１７）。

【００２８】そして、入力があった場合には（ステップ１７；Ｙ）、電気自動車制御装置７の燃料電池出力値演算部７ｃは、入力装置１２から入力された充電時間と、ステップ１１において検出され、バッテリ残容量演算装置４から供給されたバッテリ残容量とから、バッテリの残容量値を９０％以上充電するのに必要な燃料電池システム３の出力値を演算する（ステップ２２）。ステップ２２で求められた出力値は、出力値切替信号Q5 として燃料電池制御装置６に供給され、燃料電池制御装置６からはメタノール投入量調整信号Q3 と出力値設定信号Q4 とがそれぞれメタノールタンク５と燃料電池システム３とに供給される。燃料電池システム３は、出力値切替信号Q5 の指示に応じた出力でバッテリ１を充電し（ステップ２３）、電気自動車制御装置７は、バッテリ残容量が９０％以上になった場合には充電を完了する（ステップ２４）。そして、電気自動車制御装置７は、各フラグを順次オフにし（ステップ１８～ステップ２０）、燃料電池システム３の出力の停止処理を行い（ステップ２１）、リターンする。

【００２９】このようにすれば、例えば、買い物の際等の駐車時間（例えば、４時間）が、運転者により入力装置１２から入力され、このときバッテリ残容量が６０％であれば、やや効率は劣るが許容範囲内の１０ｋＷで急速充電する。また、勤務先に出社している間の駐車時間（例えば、８時間）が入力され、バッテリ残容量が６０％であれば、時間が十分あるので、効率の良い３ｋＷで充電する。そして、前者の場合には、４時間経過後に電気自動車に戻ると、バッテリ１の残容量値は９０％まで充電されているので、十分な走行可能距離を確保することができる。

【００３０】なお、本実施例では手動式の場合の充電時間は、４時間、６時間、８時間、８時間以上の各場合に設定入力できるようにしたが、これらの時間幅以外でも良く、また、３０分や１時間単位で充電時間を設定できるようにしてもよい。また、本実施例では手動式の場合の出力値を３ｋＷ、５ｋＷ、１０ｋＷとしたが、１ｋＷ単位で燃料電池システム３の出力を設定できるようにしてもよい。更に、手動式の場合、入力時間によっては、燃料電池出力値演算部７ｃの演算結果が１０ｋＷの出力を越えることが考えられる。このように演算結果が１０ｋＷを越える場合には、燃料効率が悪くなるので、出力値が一律に１０ｋＷに設定されるようにしてしもよい。更にまた、バッテリ１とインバータ２との間に「開閉手段」として機能する開閉スイッチ（図示せず）を配置し、この開閉スイッチは、駆動用電源スイッチ（イグニッションキー）１３からの入力に応じて開閉されるようにしてもよい。

【００３１】

【発明の効果】以上説明したように請求項１記載の発明によれば、モータの駆動が非許可の場合に、モータの駆動非許可の時間を利用して二次電池を充電することができる。請求項２記載の発明によれば、モータ駆動の許可・非許可は、駆動用電源スイッチと開閉手段で実現される。請求項３記載の発明によれば、モータの駆動が非許可であり、二次電池の充電残容量が所定値以下の場合に、燃料電池から自動的に充電される。請求項４記載の発明によれば、モータの駆動が非許可であり、二次電池の充電残容量が所定値以下の場合に、二次電池残容量に対応した値で燃料電池から充電が行われる。請求項５記載の発明によれば、モータの駆動が非許可の場合に、充電時間入力手段から指示入力した時間後にはバッテリ残容量を満充電にすることができる。

【図面の簡単な説明】

【図１】本発明の一実施例におけるハイブリッド電源装置が適用された電気自動車のシステム構成図である。

【図２】同上、ハイブリッド電源装置のバッテリの充電処理の動作を示すフローチャートである。

【図３】同上、図２に示すフローチャートの続きのフローチャートである。

【図４】同上、ハイブリッド電源装置に使用する燃料電池における燃料電池出力－システム総合効率特性を示す図である。

【符号の説明】

M　車両モータ

1　バッテリ（二次電池）

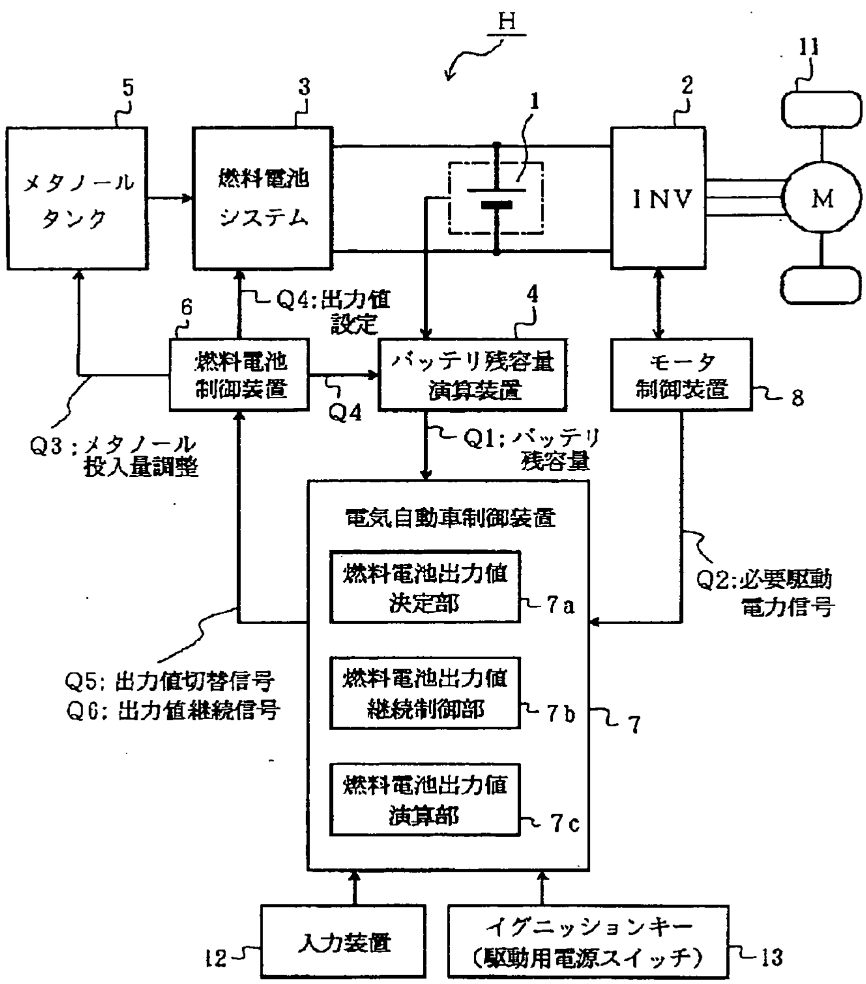
3　燃料電池システム

4　バッテリ残容量演算装置（二次電池残容量検出手段）

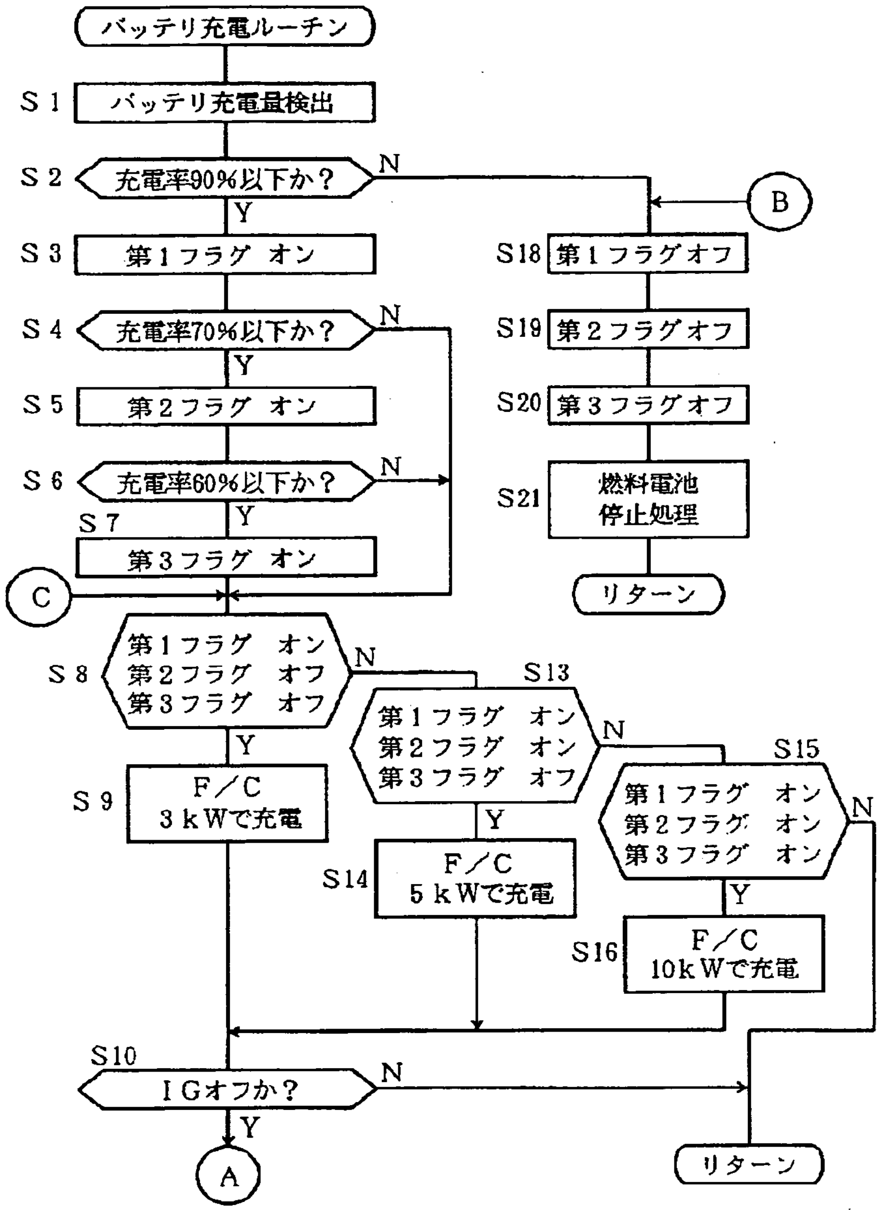
6　燃料電池制御装置

7　電気自動車制御装置
7ａ　燃料電池出力値決定部（燃料電池出力制御手段）
7ｂ　燃料電池出力値継続制御部（燃料電池出力制御手段）
＊7ｃ　燃料電池出力値演算部（燃料電池出力制御手段）
8　モータ制御装置
12　入力装置（充電時間入力手段）
＊　13　イグニッションキー（駆動用電源スイッチ）

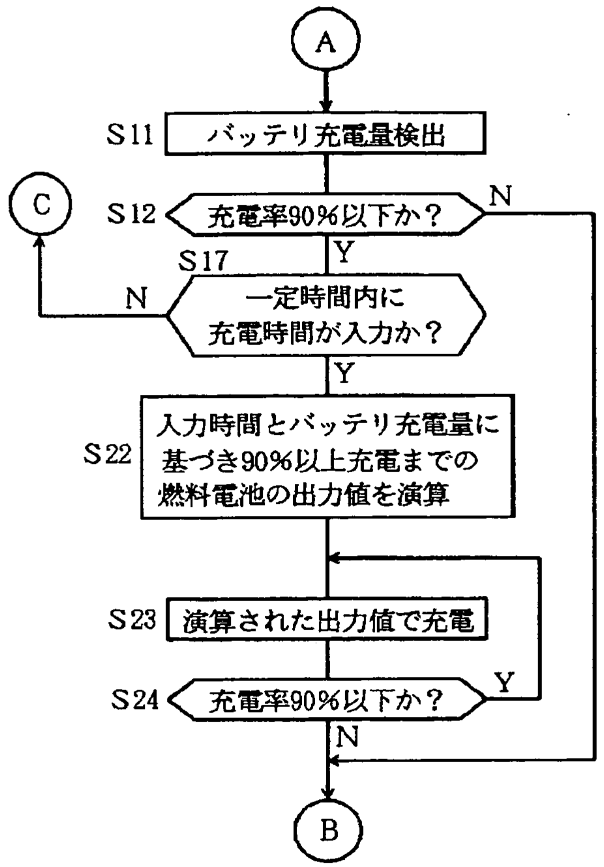
【図1】



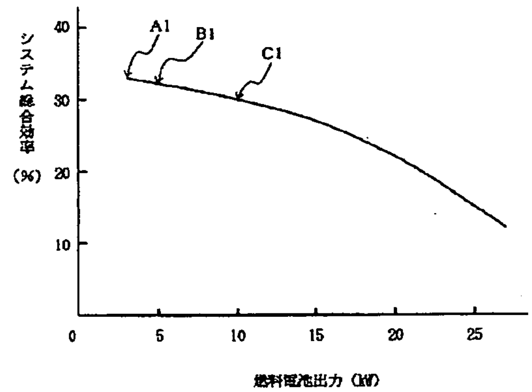
【図2】


バッテリ充電ルーチン
S1
バッテリ充電量検出
S2
充電率90%以下か？
N
Y
S3
第1フラグ　オン
S4
充電率70%以下か？
N
Y
S5
第2フラグ　オン
S6
充電率60%以下か？
N
Y
S7
第3フラグ　オン
C
B
S18
第1フラグオフ
S19
第2フラグオフ
S20
第3フラグオフ
S21
燃料電池
停止処理
リターン
S8
第1フラグ　オン
第2フラグ　オフ
第3フラグ　オフ
N
Y
S9
F／C
3kWで充電
S13
第1フラグ　オン
第2フラグ　オン
第3フラグ　オフ
N
Y
S14
F／C
5kWで充電
S15
第1フラグ　オン
第2フラグ　オン
第3フラグ　オン
N
Y
S16
F／C
10kWで充電
S10
IGオフか？
N
Y
A
リターン

【図3】



【図4】



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